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DISTRIBUTION, POPULATION SIZE AND DYNAMICS OF THE WHITE STORK *(CICONIA CICONIA L.)* IN THE UPPER AND MIDDLE OLT RIVER BASIN (ROMANIA)

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Abstract

Based on the results of the censuses carried out between 1996-2000, the total population of the Upper and Middle Olt River Basin is 721 HPa distributed in 304 localities. The total population of the region can be estimated to approx. 800 HPa. About 30% of Transylvanian population and about 16% of Romanian population breeds in the study area. From a vulnerability, conservational and monitoring point of view it is important to note that ~10% of the localities hold almost half (328 HPa - 45.49%) of the total breeding population of the whole area. The mean population density (StD) for the whole area was 5.469 HPa/100 km^2. Out of a total of 721 breeding pairs, 64% were found to nest at altitudes between 500-1000 m and only 36% nests within the altitudinal belt of 300-500 m. Most common nest sites are electric pylons (45.26%), barns (24.47%) and chimneys (22.48%). Since the 1960-s massive changes have been observed in nest site preferences, from buildings to electric pylons. The mean JZa and JZm values for the Upper and Middle Olt River Basin were above 2.0 and 2.5 in 1998-2000, values which are higher than the estimated JZa and JZm values needed to keep the population stable. The White Stork population of the Middle and Upper Olt River Basin has undergone a continuous decrease from the sixties until the end of the nineties. Positive populational changes can be seen, with the exception of the Făgăraş Basin, only in the *1988/1989-2000* period: the population has recovered to the level of the sixties and is still increasing in the Ciuc, Târgu Secuiesc and Sibiu Basins.

Keywords: White Stork, Olt River Basin, distribution, population size, breeding success, colonial nesting, nest site selection, population trends.

Introduction

The White Stork has been identified as a priority bird species in 4 out of 7 agricultural and grassland habitats of Europe (Tucker and Dixon 1997), and recently it was proposed as a habitat indicator species for agricultural habitats by Tucker *et al.* (2000). The White Stork is a flagship species for the international conservation of wetlands, ecologically valuable river lowlands and low intensity farmland as well as for the conservation of migratory birds in general (Samusenko 2000). Thus conserving the White Stork is an important contribution toward the preservation of biodiversity and consequently to the implementation of the Convention on Biological Diversity (Schulz 1999b).

The White Stork is distributed over the entire territory of Romania and the total number of breeding pairs was estimated by the last national census (1999) to ~ 4500 breeding pairs (Kósa 2001). The first regional White Stork census in this area was conducted between 1909-1915 by Jakab Schenk (Salmen 1980), but more detailed censuses were made only in the second half of the 20th century. Data on the numbers and population trends of the White Stork in the the Middle and Upper Olt River Basin were published by the following authors: Béldi (1962), Damó (1984, 1985, 1994), Demeter (2001a, 2001b), Klemm (1969, 1975a, 1975b, 1983), Klemm and Salmen (1988), Kohl (1980), Kovács (1975, 1976), Kováts (1968a, 1968b, 1974), Molnár (1979, 1981, 1990), Lutsch (1990), Lutsch, Philippi and Popa (1990), Philippi (1997), Philippi (2001), Philippi and Popa (1990b), Popa (1983), Szabó and Papp (1996), Weber and Antal (1978).

The main goal of this study was to locate and characterize the nest sites used by White Storks in the Upper and Middle Olt River Basin. The second aim was to evaluate all the population data essential for the analysis of the White Stork population in the Upper and Middle Olt River Basin to forecast its further population trends (in addition, in the future our databases will make possible further comparative analysis of the different population parameters in this area). The third aim was to elaborate recommendations for the protection of the White Stork populations and stork habitats. Partial results of our study were published by Demeter (2001a, 2001b) and Philippi (2001).

Material and Methods

Our study was carried out mainly from 1 July to 10 August 2000 when ~80% out of our data were collected in the Upper and Middle Olt River Basin. The other ~20% of the data were counted by the authors between 1996-1999.

The Upper and Middle Olt River Basin occupies the middle part of Romania (the south-eastern corner of Transylvania) and is situated within four counties (Harghita, Covasna, Brasov, Sibiu) along 386 river kilometers. The total size of the Upper and Middle Olt River Basin is 13181 km^2 (Ujvári 1972). The geographical range of the area is from 23°40'E to 26°24'E and from 45°24'N to 46°45'N. The Upper and Middle Olt River Basin consists mainly of intramountainous basins surrounded by 1500-2500

m high mountains in the NW, N, E, S and SW parts. Forests cover 35-45% of the territory, the potential White Stork habitats (arable land + pastures + meadows) amount to 50-61% .

The studied territory was subdivided into seven regions (Fig. 1):

1. Ciuc Basin: includes the catchment area of the Olt between the spring and Micfalău;

2. Târgu Secuiesc Basin: includes the catchment area of the Negru River (without the drainage area of the tributary Târlung River), the Casinu Basin and the drainage area of the Olt River between Micfalău and confluence point with the Negru River;

3. Bârsei Basin: also includes the Baraolt Basin;

4. Homoroade Rivers Basin: the hydrological drainage area of the Homoroade rivers;

5. Făgăraş Basin: includes the Olt catchment area between Racoş and the confluence point with the Lotrioara River, without the Homoroade and the Cibin River Basins;

6. Hârtibaciu River Basin: the hydrological drainage area of the Hârtibaciu River;

7. Sibiu Basin: the hydrological drainage area of the Cibin River, without the drainage area of the Hârtibaciu River.

White Stork population parameters were recorded according to the international abbreviations (Schulz 1999a):

HPa – number of pairs occupying a nest, nesting pairs (HPa=HPm+HPo+HPx);

HPm – number of pairs with fledglings;

HPo – number of pairs occupying a nest but without fledgling;

HPx – number of pairs with unknown breeding success;

JZG – total number of fledglings in a defined area per year;

JZa – breeding success, avearage number of fledged young per pair related to all HPa of a defined area (JZG/HPa);

JZm – breeding success, average number of fledged young per pair related to all HPm of a defined area (JZG/HPm);

Std – "Stork density": number of pairs (HPa) per 100 sq km of a defined area.

Data analysis was made with the FileMaker Pro software and the distribution maps were produced with the DMAP software.

Results and discussion

Distribution, population size and density

The White Stork breeds all over the study area with the exception of high mountainous regions and forested areas. Distribution of breeding pairs (HPa) is presented in Fig. 2. The species was identified in 304 localities (Table 5.). The distribution of the White Stork throughout the area is uneven. It reaches the highest

densities in the Ciuc and Târgu Secuiesc Basins, where grasslands are more widespread as compared to other regions.

Based on the results of the censuses carried out between 1996-2000, the total population of the Upper and Middle Olt River Basin is 721 HPa (Table 1. and Table 5.). As about 15% of the region was not covered by the censuses (mainly the small settlements from the mountainous area), the total population is estimated to approx. 800 breeding pairs.

About 30% of Transylvanian population and about 16% of Romanian population breeds in the study area. The percentage of unsuccesful pairs (%HPo) was low in 2000, only 10.017%.

The mean population density (StD) for the whole area was 5.469 HPa/100 km^2 (Table 1.). It is higher than the average value for Romania (4.48 HPa/100 km^2 - Kósa 2001) and much higher than for the Someş River Basin (2.78 HPa/100 km^2 - Kósa, *unpublished results*).

Breeding pairs were found in 100 full 10-km UTM squares and in 3 partial 10-km squares (from a total of 139 full and 7 partial 10-km squares) (Fig. 3). The species distribution thus covers 70.54% of the total area covered by the 146 UTM squares.

While the territory is not a typical stork habitat (Kováts 1968a), White Stork being a lowland grassland bird, the local density of breeding pairs in some places reaches 50 pairs/100 km^2 (in the UTM square 35TMM12) (Fig. 3), which is close to the maximal densities in Europe, and one of the highests in Romania.

Although the highest pair densities can now be found in the Ciuc Basin, Kováts (1968a, 1968b) put forward a hypothesis on a relative recent colonization of the Ciuc Basin by White Storks, based on the memories of elderly local people: the first nests appeared as late as during the second half of the 19^{th} century, and spread from South to North. This hypothesis is apparently supported by the breeding data from the Upper and Middle Olt River Basin, published in the ornithological journal Aquila for the period 1906-1910: from a total of 49 "stork villages" only one, Sâncraieni is mentioned from the Ciuc Basin.

Some ringing recoveries also support the hypothesis of Kováts. The White Stork HGB 1257 ringed by Jakab Schenk in 1909 in Hăghig (Bârsei Basin) was recovered after four years in Joseni (Gheorgheni Basin) at a distance of 113 km to the north from the ringing site (Salmen 1980, Cătuneanu 1999). Three White Storks ringed by R. Iacobi in Arini (Bârsei Basin) were recovered later in NE and NW (Cătuneanu 1999; unfortunately the exact details of ringing and recovery places and dates are missing). All these four recoveries suggest a northward movement of some White Storks from the Bârsei Basin.

A gradual decrease in breeding pair density (StD) was found from the Upper Olt River Basin (Ciuc and Târgu Secuiesc Basins StD=7.11-7.68) to the Middle Olt River Basin (StD=4.35-5.97) (Table 1.), probably in close connection with changes in habitat.

Vertical distribution

Out of a total of 721 breeding pairs, 64% were found to nest at altitudes between 500-1000 m and only 36% nests within the altitudinal belt of 300-500 m (Fig. 4). To the best of our knowledge this altitudinal distribution is unique for the Carpathian Basin and probably also for Europe.

Breeding success

The JZa and JZm values, which characterize the breeding success, were calculated only for the year 2000. In this year 579 HPa (500 HPm + 21 HPx + 58 HPo) and 1669 JZG were recorded distributed in 206 localities. The mean JZa and JZm values for the Upper and Middle Olt River Basin were 2.883 and 3.338. The JZa and JZm values needed to keep the population stable are estimated to 2.0 (Burnhauser 1983) and 2.5 (Lakeberg 1995). As it can be seen in Table 1., the JZa values exceed 2.0 and the JZm values 2.5 in every studied region in 2000. Because high JZa and JZm values were registered also in the 1998-1999 period (Demeter 2001a, Kósa 2001 and other not published data), the White Stork population from the Upper and Middle Olt River Basin can be considered as a stable one.

The frequency distribution of brood size in 2000 for the study area was the following (Fig. 5): the percentage of nests with 1 young (HPm1) was 1.96%, HPm2 - 15.19%, HPm3 – 37.25%, HPm4 – 36.52%, HPm5 – 8.57%. Extremely high number of fledglings (6) was recorded for two nests.

Aggregability and colonial nesting

We used the following definition for White Stork colonies: villages with minimum 5 breeding pairs (Guziak and Jakubiec 1996) among which the maximal distance does not exceed 1 km (Chozas *at al.* 1989). White Stork colonies were identified in 31 localities of the Upper and Middle Olt River Basin (Fig. 2. and Table 5.). From a vulnerability, conservational and monitoring point of view it is important to note that ~10% of the localities hold almost half (328 HPa - 45.49%) of the total breeding population of the whole area!

In order to compare quantitatively the aggregability of White Storks in different regions we introduced two parameters:

I – *intensity* of colonial breeding (proportion of breeding pairs nesting in colonies);

F- *frequency* of colonial breeding (proportion of localities with colonies).

As Fig. 6 shows, the intensity (I) and frequency (F) of colonial breeding is the highest in the Ciuc, Sibiu and Târgu Secuiesc Basins. The highest aggregability levels ($I > 55\%$ and $F > 15\%$) thus occur in the regions characterized also with the highest StD values (Table 1.).

JZa and JZm values calculated for the White Stork colonies (JZa=2.899 and JZm=3.302, n=328 HPa) were almost identical with the values for those localities where only 1-4 HPa breeds (JZa=2.861 and JZm=3.387, n=252 HPa). This is in

contrast with the findings of Radkiewicz (1989) who noted greater JZa and JZm values for White Storks colonies compared to solitary nests in West Poland.

The largest stork colonies can be found in the localities Cristian (30 HPa) and Sânsimion (27 HPa).

Nest site selection

The most common nest sites in the Upper and Middle Olt River Basin are electric pylons (45.26%), barns (24.47%) and chimneys (22.48%) (Table 2.). The frequency distribution of nest sites for Romania is the following: 69.31% of nests are constructed on electric pylons and 27.40% on buildings (chimneys + barns + roofs) (Kósa 2001). Thus the study area remains behind other regions in Romania as far as the proportion of nests constructed on electric pylons is concerned.

As Table 2. shows, there are regional differences in nest site preferences. The proportion of nests constructed on barns is the highest in the Ciuc and Târgu Secuiesc Basins (34.85-36.69%) and chimneys are preferred as nesting sites in the Bârsei and Sibiu Basins (43.97-54.16%) (Table 2.).

During the last decades massive changes have been observed in nest site preferences, from buildings to electricity pylons. This process differed significantly in various parts of the study area.

44 years ago White Storks in the Târgu Secuiesc Basin placed their nests exclusively on buildings and trees (Béldi 1962). In 1962-1963 Kováts found no nests constructed on electric poles in the Ciuc and Târgu Secuiesc Basins (Kováts 1968a,1968b). Weber and Antal observed in Ciuc Basin in 1973 only nests constructed on buildings and in trees (Weber and Antal 1978). The first White Stork nests placed on electric poles were recorded in the late 1960-es by Dénes Emese in the Târgu Secuiesc Basin (Lemnia). In this region their proportion rapidly increased: from 3.2% in 1978 (Molnár 1979) to 15.6% in 1988 (Molnár 1990) and to 54.28% in 2000.

The situation is different in the Bârsei Basin. In 2000 the proportion of nests constructed on electric poles was still the lowest in the entire region (24.11%). The proportion of nests constructed on electric poles remained below 50% in the Făgăraş and Sibiu Basins and in the Hârtibaci River Basin, too.

The largest proportion of nests constructed on electric pylons can be found in the north and north-west of the area (Ciuc Basin, Homoroade Rivers Basin). The reason for this is most probably that nests built on electric poles spread from north (Gheorgheni Basin) and north-west (Mureş County) to the Ciuc and Homoroade Rivers Basins.

The proportion of nests placed on poles increased in parallel with the decrease of nests placed on buildings (see for example Molnár 1979, 1981). As suitable nesting places on chimneys and barns are becoming less abundant, electric poles probably serve as a substitute.

In the middle of the 1990s, in cooperation with the national electricity company, the installation of artificial nest platforms on electricity poles was begun in Harghita and Covasna counties (Upper Olt River Basin) and until 2000 about 86 poles were equipped with such platforms. No platforms were installed in Braşov and Sibiu

counties (Middle Olt River Basin). Consequently, there are still 234 nests in direct contact with electric wires.

Population trends

The Upper and Middle Olt River Basin, considering the available amount of White Stork population data, is one of the most studied areas in Romania. Despite this fact, the summarised data of the former censuses conducted between 1958-2000 cannot be directly compared for studies on population dynamics. Difficulties arise from the fact that during the censuses the sample areas were different and also when they were the same, in different years different localities were included in the monitoring.

To be able to compare the population trends between different regions in a given time period, we divided the whole time interval, based on the available census data, into the following periods: 1962/1963-1973/1974, 1973/1974-1988/1989 and 1988/1989-2000. Only those localities were included in the analyses where census data are available in two consecutive occasions. Despite the problems mentioned above, data obtained in this way provide a reliable basis to estimate simultaneously the long term population changes for the White Stork in the different regions of the Upper and Middle Olt River for a given time period (Table 3.).

The data presented in Table 3. show regional differences in population trends.

Although both in the Upper and Middle Olt River Basins the White Stork population decreased from the sixties to the seventies, this was more pronounced in the Sibiu and Făgăraş Basins (~ -28.3 - -43.82%) than in the Ciuc Basin (~ -10%). Among the causes of the decline Klemm (1983) listed the disappearance of wetlands due to drainage and river regulation following a systematic government plan and structural changes of the human settlements and attitudes with transition to urban building and behaviour.

In the *1973/1974-1988/1989* period the decline of Stork populations continues in all the regions from where census data are available. A clear difference can be seen in population decrease rate between the Upper and Middle Olt River Basins: the values are situated between -1.6 – -14.6% in the Upper Olt River Basin, and between –15.38 - -41% in the Middle Olt River Basin. The Olt River was drastically regulated in the Ciuc Basin in the late 1970-s, early 1980-s. As a result, the water table dropped and floods occur only rarely. The effect on the flora and fauna was dramatic, several species disappeared from the area. Unfortunately White Stork breeding data are lacking between 1973 and 1997 so we do not know in what manner was affected the breeding population in the first years after the river regulation. The Negru River (Târgu Secuiesc Basin) was regulated in 1974 and Kováts (1975) noted a marked drop in the number of breeding pairs in the localities situated along the river.

Positive population changes occured only in the *1988/1989-2000* period: the populations recovered to the level of the sixties and are still increasing in the Ciuc, Târgu Secuiesc and Sibiu Basins. The present positive population trend of the White Stork in Eastern Europe is generally attributed to the crisis in agriculture during the economic transition period, which resulted in a rapid recovery of biological diversity on agricultural landscapes in these countries (Schulz 1999b). Although this statement

seems to be true also for Romania, we cannot exclude the possibility that populational increases observed in some regions (e.g. Sibiu Basin) are resulted from the immigration of breeding pairs from the most affected areas (e.g. Făgăraş Basin).

No HPa changes, compared to 1988/1989, took places in the Bârsei Basin.

The only region in the Middle and Upper Olt River Basin where the population decrease continues is the Făgăraş Basin (-20.1%). The Olt River valley from this region was classified as D-degraded in 1994 and remains one of the most polluted and degraded river sectors in the Upper and Middle Olt River Basin.

The breeding White Stork population in the lower sector of the Făgăras Basin was negatively influenced probably also by the presence of some large dam-hydroelectric power station systems (CHE Arpaşu de Jos, CHE Scorei, CHE Avrig, CHE Racoviţa) built between 1970-1990. The population decrease of White Storks in this sector can be seen in Table 4.

Conclusions

Based on the results of the censuses carried out between 1996-2000, the total population of the Upper and Middle Olt River Basin is 721 HPa distributed in 304 localities. The total population of the region can be estimated to approx. 800 HPa. In only 31 localities breeds about half (328 HPa) of the total breeding population of the area.

The mean population density (StD) for the whole area was 5.469 HPa/100 km^2, that is higher than the average value for Romania (4.48 HPa/100 km^2). Out of a total of 721 breeding pairs, 64% were found to nest at altitudes between 500-1000 m and only 36% nests within the altitudinal belt of 300-500 m.

Most common nest sites in the Upper and Middle Olt River Basin are electric pylons (45.26%), barns (24.47%) and chimneys (22.48%). Since the 1960-s massive changes have been observed in nest site preferences, from buildings to electric pylons. This process differed significantly in various parts of the study area.

The mean JZa and JZm values for the Upper and Middle Olt River Basin were above 2.0 and 2.5 in 1998-2000, values which are higher than the estimated JZa and JZm values needed to keep the population stable, thus the White Stork population from the Upper and Middle Olt River Basin can be considered as a stable one.

The White Stork population of the Middle and Upper Olt River Basin has undergone a continuous decrease from the sixties until the end of the nineties. Positive populational changes can be seen, with the exception of the Făgăraş Basin, only in the *1988/1989-2000* period: the population has recovered to the level of the sixties and is still increasing in the Ciuc, Târgu Secuiesc and Sibiu Basins.

From a conservational point of view it is necessary to continue the monitoring of the White Stork populations in key sites (localities with more than 5 HPa). As the foreseeable introduction of the EU agricultural policy in Romania will damage White Stork feeding habitats, increasing efforts are needed to protect these regions. The installation of nestplatforms on electric poles must be continued and extended also in the Middle Olt River Basin.

Figure 1. Regional distribution of localities with White Stork nests in 1996-2000 (in brackets the number of localities whith nests in a given region)

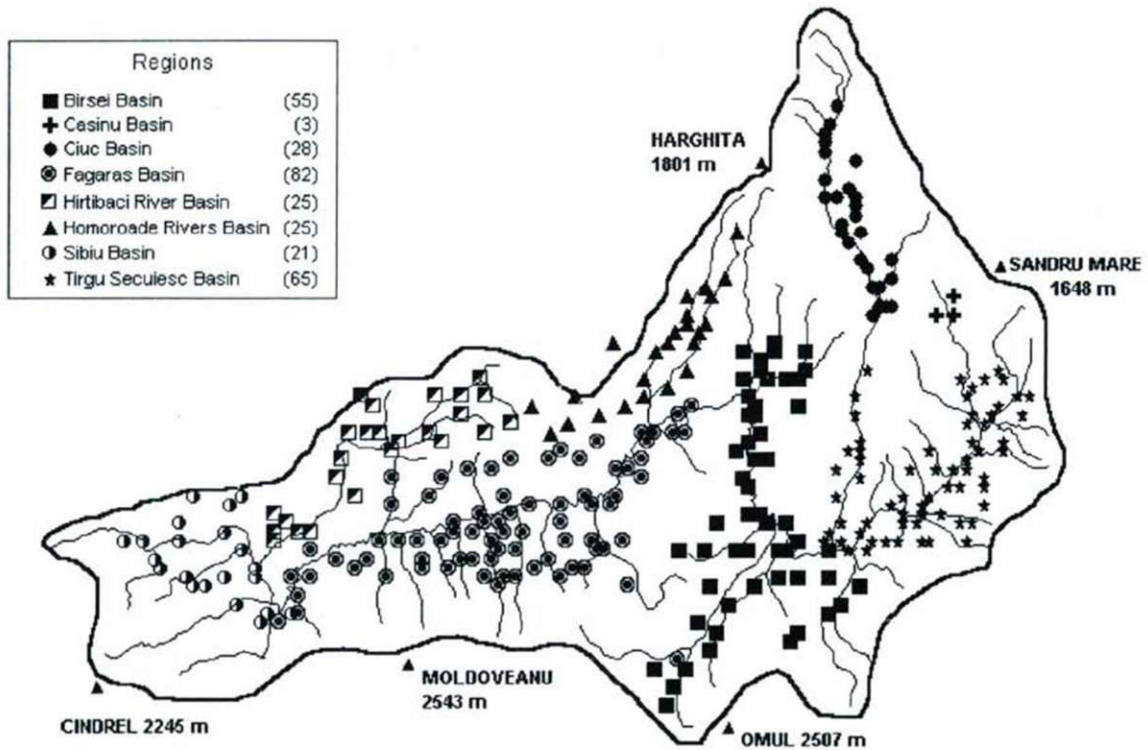
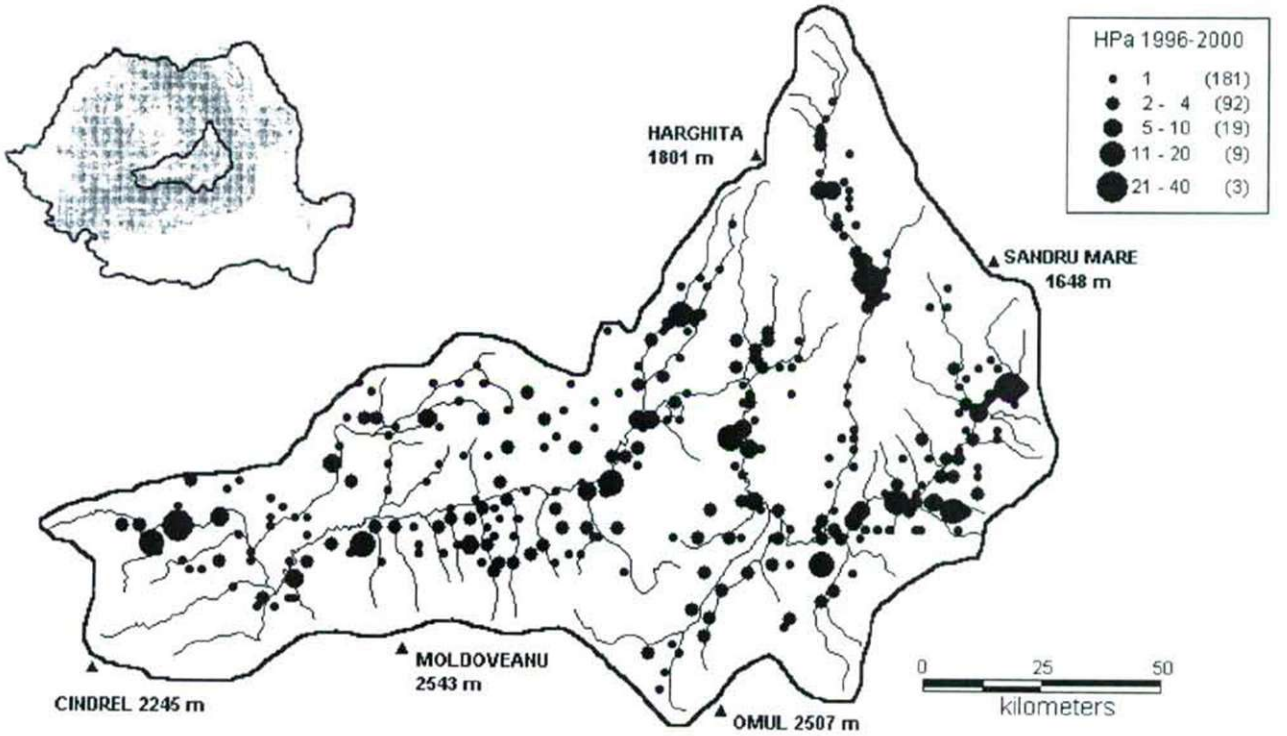


Figure 2. Distribution and number of White Stork breeding pairs (HPa) in the Upper and Middle Olt River Basin (1996-2000)
(Upper left corner: position of the study area in Romania; in brackets the number of localities corresponding to a given HPa range)



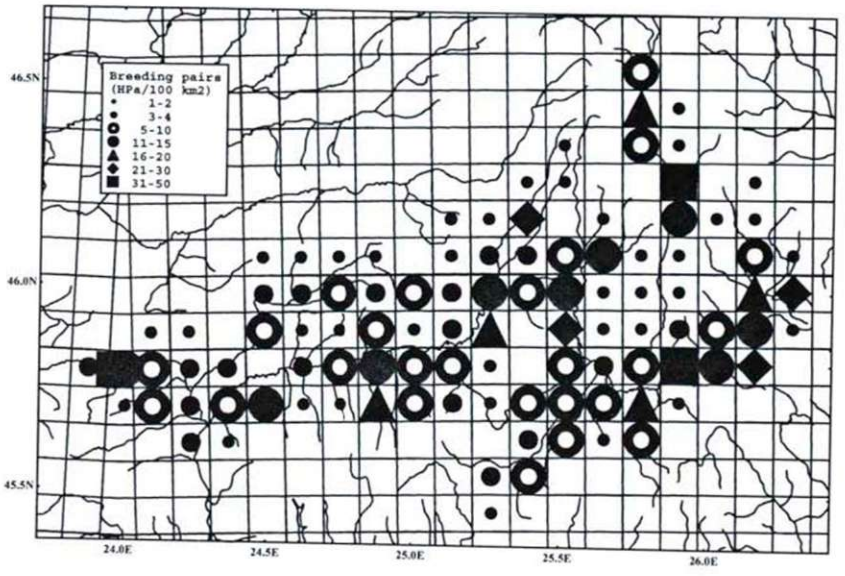


Figure 3. Distribution of White Stork pair densities (StD=HPa/100 km^2) in the Upper and Middle Olt River Basin in 1996-2000 (UTM grid, 10x10 km quadrants)

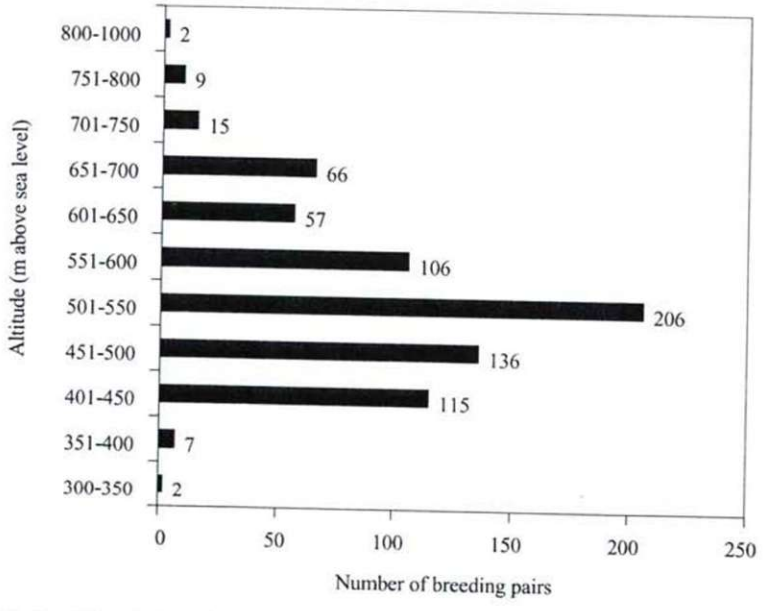


Fig. 4. Altitudinal distribution of nesting pairs (HPa) in the Upper and Middle Olt River Basin in 1996-2000 (n=721)

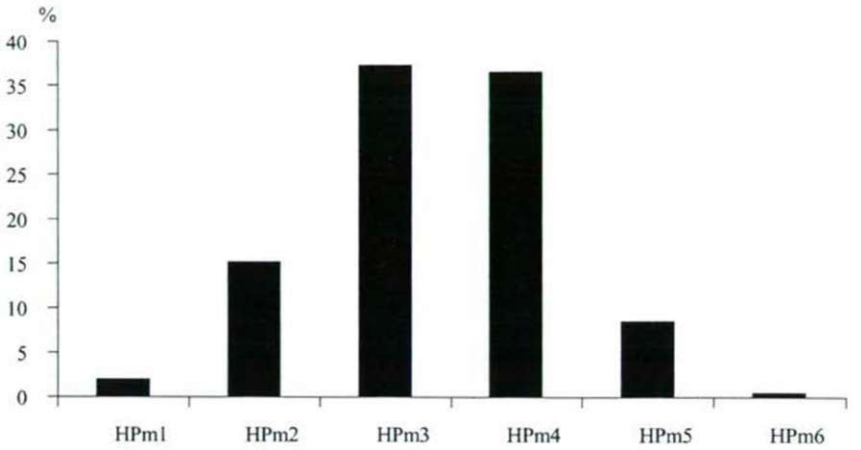


Fig. 5. The frequency distribution of brood size in the Upper and Middle Olt River Basin in 2000 (n=408 HPm)

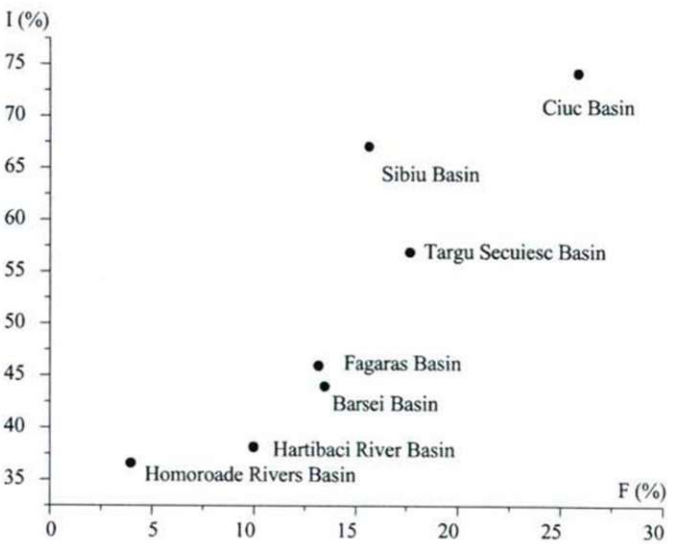


Fig. 6. Aggregability of breeding White Storks in the Upper and Middle Olt River Basin in 1996-2000 (F - frequency of colonial breeding; I - intensity of colonial breeding)

Table 1. Population and breeding parameters of the White Stork in the Upper and Middle Olt River Basin in 1996-2000

	Regions	Area (km^2)	Nr. of localities with stork nests	H	HPa	HPm	HPo	HPx	HE	uH	JZa*	JZm*	StD
Upper Olt River Basin	Ciuc Basin	1288	28	109	99	79	19	1	1	9	2.80	3.49	7.68
	Târgu Secuiesc Basin	2291	68	176	163	127	24	12	6	7	2.61	3.22	7.11
	Bârsei Basin	2760	55	148	133	121	8	4	4	11	2.97	3.27	4.81
Middle Olt River Basin	Homoroade Rivers Basin	837	25	52	50	42	6	2	0	2	2.76	3.34	5.97
	Făgăraş Basin	3768	82	175	164	143	13	8	2	9	3.01	3.40	4.35
	Hârtibaci River Basin	1031	25	40	40	39	1	0	0	0	3.63	3.73	3.87
	Sibiu Basin	1206	21	72	72	66	6	0	0	0	2.87	3.14	5.97
	TOTAL	13181	304	772	721	617	77	27	13	38	2.883	3.338	5.469

* JZa and JZm values were calculated only for 2000

Table 2. Distribution of different nest support types of White Stork nests in the Upper and Middle Olt River Basin

	Regions	Electric pylon (total)	Electric pylon without support	Electric pylon with support	Chimney	Roof	Barn	Tree	Other	Total
Upper Olt River Basin	Ciuc Basin	62 (56.88%)	22 (20.18%)	40 (36.69%)	4 (3.66%)	0	40 (36.69%)	3 (2.75%)	0	109
	Târgu Secuiesc Basin	95 (54.28%)	71 (40.57%)	24 (13.71%)	12 (6.85%)	3 (1.71%)	61 (34.85%)	4 (2.28%)	0	175
	Bârsei Basin	34 (24.11%)	29 (20.56%)	5 (3.54%)	62 (43.97%)	12 (8.51%)	26 (18.43%)	5 (3.54%)	2 (1.41%)	141
Middle Olt River Basin	Homoroade Rivers Basin	29 (64.44%)	12 (26.66%)	17 (37.77%)	7 (15.55%)	3 (6.66%)	3 (6.66%)	0	3 (6.66%)	45
	Făgăraş Basin	69 (41.81%)	69 (41.81%)	0	41 (24.84%)	5 (3.03%)	43 (26.06%)	6 (3.63%)	1 (0.6%)	165
	Hârtibaci River Basin	11 (45.83%)	11 (45.83%)	0	7 (29.16%)	5 (20.83%)	0	0	1 (4.16%)	24
	Sibiu Basin	20 (41.66%)	20 (41.66%)	0	26 (54.16%)	2 (4.16%)	0	0	0	48
	Total	320 (45.26%)	(234) (33.09%)	(86) (12.16%)	159 (22.48%)	30 (4.24%)	173 (24.47%)	18 (2.54%)	7 (0.99%)	707

Table 3. Population trends of the White Stork in the Upper and Middle Olt River Basin between 1962-2000 (based on data published by Klemm (1975a, 1975b), Kovács (1976), Kováts (1968a, 1968b), Lutsch (1990), Lutsch, Philippi and Popa (1990), Molnár (1978, 1990), Philippi and Popa (1990), Weber and Antal (1978)) (n – number of compared localities)

	1962/63-1973/74	1973/74-1988/89	1988/89-2000
Ciuc Basin	**- 9.75 %** (1962: 82 HPa→ 1973: 74 HPa; n=15)	**+ 14.86 %** (1973: 74 HPa → 2000: 85 HPa; n=15)	
Târgu Secuiesc Basin	**- 26 %** (1963: 92 HPa → 1974: 68 HPa; n=21)	**- 1.6 %** (1974: 123 HPa → 1988: 121 HPa; n=41)	**+ 15.7 %** (1988: 121 HPa → 2000: 140 HPa; n=41)
		+ 11.38 %	
Bârsei Basin	**- 26.8 %** (1963: 41 HPa → 1974: 30 HPa; n=13)	**- 14.6 %** (1974: 89 HPa → 1988/1989: 76 HPa; n=28)	**0 %** (1988/1989: 85 HPa → 2000: 85 HPa; n=32)
		- 17.98 % (1974: 89 HPa → 2000: 73 HPa; n=28)	
Homoroade Rivers Basin	-	-	**+ 12.5 %** (1989: HPa 8 → 2000: 9 HPa; n=7)
	- 9.09 % (1962: 22 HPa → 2000: 20 HPa; n=7)		
Hârtibaciul River Basin	-	**- 41.17 %** (1974: 34 HPa → 1989: 20 HPa; n=12)	**+ 25 %** (1989: 20 HPa → 2000: 25 HPa; n=12)
		- 26 %	
Făgăraş Basin	**- 43.82 %** (1963: 89 HPa → 1974: 50 HPa; n=5)	**- 23.68 %** (1974: 38 HPa → 1989: 29 HPa; n=3)	**- 20.17 %** (1989: 114 HPa → 2000: 91 HPa; n=37)
Sibiu Basin	**- 28.3 %** (1963: 74 HPa → 1974: 53 HPa; n=11)	**- 15.38 %** (1974: 52 HPa → 1989: 44 HPa; n=11)	**+ 38.63 %** (1989: 44 HPa → 2000: 61 HPa; n=11)
		+ 17.3 %	

Table 4.: The population decrease of White Stork in the lower sector of the Făgăraş Basin (based on data published by Klemm (1975b), Philippi and Popa (1990))

Locality	1963	1974	1989	2000
Avrig	12	6	7	2
Racoviţa	16	12	11	6
Săcădate	18	11	0	1
Scorei	42	20	11	11
Total	88	49	29	20

Table 5. List of localities with White Stork nests in the Upper and Middle Olt River Basin in 1996-2000 (Abbreviations: counties: BV - Braşov, CV- Covasna, HR - Harghita, SB - Sibiu; regions: BIRS - Bârsei Basin, CASI - Caşinu Basin, CIUC - Ciuc Basin, FAGA - Făgăraş Basin, HIRT - Hârtibaci River Basin, HOMO - Homoroade Rivers Basin, SIBI - Sibiu Basin, TSEC- Târgu Secuiesc Basin; Latitude and longitude are expressed in decimal degrees)

Locality	County	Latitude	Longitude	UTM code	Altitude (m)	Region	H	HPa	HPm	HPo	HPx	HE	uH	JZG	JZa	JZm	Electric pylon	Pylon with	Chimney	Roof	Barn	Tree	Other	Census year
AGNITA	SB	45.9667	24.6167	35TLL19	500	HIRT	1	1	1					4	4.00	4.00	1							2000
AITA MARE	CV	45.9667	25.5500	35TLL89	474	BIRS	9	7	6		1		2	21	3.00	3.50	1	1	2		5			2000
AITA MEDIE	CV	45.9833	25.5833	35TLL99	513	BIRS	1	1		1					0.00	0.00				1				1997
AITA SEACĂ	CV	46.0333	25.6833	35TLL99	622	BIRS	1	1	1					2	2.00	2.00			1					2000
ALDEA	HR	46.2500	25.4333	35TLM72	640	HOMO	1	1	1					3	3.00	3.00	1							2000
ALŢINA	SB	45.9333	24.4667	35TLL08	478	HIRT	1	1	1					1	1.00	1.00								2000
ANINOASA	CV	45.8166	25.9666	35TML17	538	TSEC	1	1			1				0.00	0.00					1			2000
APAŢA	BV	45.9500	25.5167	35TLL88	506	BIRS	15	13	9	4		1	1	31	2.38	3.44	7		4		3			2000
APOŞ	SB	46.0333	24.5500	35TLM10	527	HIRT	1	1	1					4	4.00	4.00	1							2000
ARACI	CV	45.8167	25.6500	35TLL97	506	BIRS	2	2	2					5	2.50	2.50	1				1			2000
ARINI	BV	45.8833	25.5500	35TLL88	489	BIRS	1	1	1					3	3.00	3.00					1			2000
ARIUŞD	CV	45.7833	25.6833	35TLL97	501	BIRS	1	1	1					3	3.00	3.00	1							2000
ARPAŞUL DE JOS	SB	45.7833	24.6167	35TLL17	400	FAGA	2	2			2				0.00	0.00			2					2000
AUGUSTIN	BV	46.0500	25.5500	35TLM80	442	BIRS	1	1	1					5	5.00	5.00	1							1999
AVRIG	SB	45.7167	24.3833	35TKL96	377	FAGA	2	2	2					7	3.50	3.50	1							2000
BĂCEL	CV	45.7667	25.8167	35TML06	506	TSEC	3	3	2		1			5	1.67	2.50	3							1999
BACIU (SĂCEL)	BV	45.6000	25.6667	35TLL95	968	BIRS	1						1		0.00	0.00								1998
BANCU	HR	46.3000	25.9333	35TMM12	691	CIUC	1	1		1					0.00	0.00					1			1998
BARAOLT	CV	46.0833	25.6000	35TLM90	482	BIRS	2	2	2					9	4.50	4.50	1		1					2000
BĂRCUT	BV	46.0000	24.9167	35TLL39	581	HIRT	1	1	1					4	4.00	4.00			1					2000
BÂRGHIŞ	SB	45.9833	24.5333	35TLL09	447	HIRT	2	2	2					9	4.50	4.50								2000
BÂRZAVA	HR	46.4333	25.8167	35TMM04	769	CIUC	1	1	1					5	5.00	5.00	1							2000
BĂŢANII MICI	CV	46.1000	25.7000	35TLM90	518	BIRS	1	1	1					3	3.00	3.00		1						2000
BĂŢANII MARI	CV	46.0833	25.6833	35TLM90	515	BIRS	1	1	1					3	3.00	3.00			1					2000
BECLEAN	BV	45.8333	24.9167	35TLL37	423	FAGA	5	4	4				1	13	3.25	3.25	3			1	1			2000
BEIA	BV	46.1500	25.1833	35TLM51	522	HOMO	2	1	1				1	2	2.00	2.00	1				1			2000

Table 5. (continued)

Locality	County	Latitude	Longitude	UTM code	Altitude (m)	Region	H	HPa	HPm	HPo	HPx	HE	uH	JZG	JZa	JZm	Electric pylon	Pylon with	Chimney	Roof	Barn	Tree	Other	Census year
BELANI	CV	46.0833	26.1833	35TMM30	591	TSEC	1	1			1				0.00	0.00	1							2000
BELIN	CV	45.9333	25.5667	35TLL88	493	BIRS	9	9	9					36	4.00	4.00	1				4			2000
BELIN VALE	CV	45.9333	25.6000	35TLL98	591	BIRS	1	1	1					2	2.00	2.00					1			2000
BERIVOI (MARE)	BV	45.7333	24.9833	35TLL46	532	FAGA	2	2	2					5	2.50	2.50					2			1996
BIBORŢENI	CV	46.0833	25.6500	35TLM90	495	BIRS	1	1	1					3	3.00	3.00		1						2000
BICFALĂU	CV	45.7667	25.8667	35TML16	565	TSEC	1	1	1					3	3.00	3.00		1						2000
BITA	CV	45.8333	25.9667	35TML17	525	TSEC	14	13	13			1		43	3.31	3.31	3				11			2000
BIXAD	CV	46.1000	25.8667	35TMM10	663	TSEC	1	1	1					4	4.00	4.00					1			2000
BOD	BV	45.7667	25.6500	35TLL96	498	BIRS	3	2	2				1	8	4.00	4.00			2	1				2000
BODOC	CV	45.9500	25.8500	35TML18	549	TSEC	1	1	1					4	4.00	4.00					1			1999
BOGATA OLTEANĂ	BV	45.9833	25.3500	35TLL79	460	FAGA	2	1	1				1	2	2.00	2.00	1					1		2000
BOIŢA	SB	45.6333	24.2500	35TKL85	350	SIBI	1	1	1					4	4.00	4.00			1					2000
BOROŞNEU MARE	CV	45.8167	26.0000	35TML27	564	TSEC	3	3	3					10	3.33	3.33	3							2000
BOROŞNEU MIC	CV	45.7833	26.0167	35TML27	680	TSEC	1					1			0.00	0.00	1							1997
BRĂDENI	SB	46.0833	24.8333	35TLM30	520	HIRT	1	1	1					4	4.00	4.00	1							2000
BRADU	SB	45.7167	24.3333	35TKL96	338	FAGA	1	1	1					5	5.00	5.00				1				2000
BRĂDUŢI	CV	46.1333	25.6167	35TLM90	509	BIRS	2	2	2					4	2.00	2.00			1			1		2000
BRAN	BV	45.5167	25.3500	35TLL74	776	BIRS	1	1	1					3	3.00	3.00			1					1996
BRATEŞ	CV	45.8333	26.0667	35TML27	529	TSEC	7	6	6				1	19	3.17	3.17	2	3			2			2000
BREAZA	BV	45.7000	24.8833	35TLL36	607	FAGA	3	3	3					7	2.33	2.33			1		2			1996
BREŢCU	CV	46.0500	26.3000	35TML49	592	TSEC	4	4	1	2	1			2	0.50	2.00	2	2						2000
BRUIU	SB	45.8667	24.7000	35TLL28	514	FAGA	1	1	1					2	2.00	2.00				1				1999
BUCIUM	BV	45.7333	25.0833	35TLL56	556	FAGA	1	1			1				0.00	0.00	1							1999
BUDILA	BV	45.6667	25.8000	35TML05	581	BIRS	2	2	1		1			4	2.00	4.00	1					1		2000
CALBOR	BV	45.8667	24.9000	35TLL38	508	FAGA	2	2	2					6	3.00	3.00	1				1			1996
CĂPENI	CV	46.0333	25.5667	35TLL89	468	BIRS	1	1	1					3	3.00	3.00			1					2000
CÂRPINIŞ	BV	45.6500	25.7667	35TML05	597	BIRS	3	3	3					6	2.00	2.00	1		1					1998
CÂRŢA	HR	46.5333	25.7500	35TMM05	735	CIUC	1	1	1					3	3.00	3.00			1					2000

Table 5. (continued)

Locality	County	Latitude	Longitude	UTM code	Altitude (m)	Region	H	HPa	HPm	HPo	HPx	HE	uH	JZG	JZa	JZm	Electric pylon	Pylon with	Chimney	Roof	Barn	Tree	Other	Census year
CÂRŢA	SB	45.7833	24.5667	35TLL17	409	FAGA	2	2	1	1				4	2.00	4.00							1	2000
CÂRŢIŞOARA	SB	45.7167	24.5833	35TLL16	526	FAGA	1					1			0.00	0.00								1998
CAŞINU NOU	HR	46.2000	26.0500	35TMM21	698	CASI	1	1	1					2	2.00	2.00			1					1998
CAŞOLŢ	SB	45.7833	24.2833	35TKL87	405	HIRT	1	1	1					3	3.00	3.00								2000
CAŢA	BV	46.0833	25.2667	35TLM60	442	HOMO	1	1	1					3	3.00	3.00							1	2000
CATALINA	CV	45.9666	26.1500	35TML39	551	TSEC	1	1			1				0.00	0.00	1							2000
CERNAT	CV	45.9500	26.0333	35TML28	554	TSEC	2	2	1	1				2	1.00	2.00	1					1		1997
CETĂŢUIA	HR	46.2500	25.9000	35TMM12	662	CIUC	12	12	10	2				33	2.75	3.30		7			5			2000
CHICHIŞ	CV	45.7833	25.8000	35TML07	508	TSEC	4	3	3				1	7	2.33	2.33	3		1					2000
CHIRPĂR	SB	45.9000	24.6000	35TLL18	481	FAGA	1	1	1					5	5.00	5.00			1					2000
CHIURUŞ	CV	45.8167	26.1500	35TML37	618	TSEC	2	2	1	1				2	1.00	2.00					2			1997
CIBA	HR	46.3500	25.8000	35TMM03	664	CIUC	1	1	1					5	5.00	5.00	1							2000
CICEU	HR	46.4167	25.7833	35TMM04	676	CIUC	10	10	6	4				21	2.10	3.50	2	1			7			2000
CINCŞOR	BV	45.8333	24.8333	35TLL37	406	FAGA	1	1	1					2	2.00	2.00			1					1996
CINCU	BV	45.9167	24.8000	35TLL28	458	FAGA	1					1			0.00	0.00								1998
CIŞNĂDIE	SB	45.7167	24.1500	35TKL76	472	SIBI	4	4	4					15	3.75	3.75								2000
CIŞNĂDIOARA	SB	45.7000	24.1000	35TKL76	693	SIBI	1	1	1					3	3.00	3.00								2000
COBOR	BV	45.9500	25.0500	35TLL49	583	FAGA	1	1	1					2	2.00	2.00			1					1996
CODLEA	BV	45.7000	25.4500	35TLL76	546	BIRS	3	3	3					7	2.33	2.33	3							2000
COLONIA BOD	BV	45.7667	25.6333	35TLL96	514	BIRS	1	1			1				0.00	0.00			1					2000
COMANA DE JOS	BV	45.9167	25.2333	35TLL68	453	FAGA	2	2	2					6	3.00	3.00	1				1			2000
COMANA DE SUS	BV	45.9000	25.2667	35TLL68	527	FAGA	1	1	1					5	5.00	5.00					1			2000
COPĂCEL	BV	45.7333	24.9833	35TLL46	532	FAGA	1	1	1					3	3.00	3.00					1			1996
COŞENI	CV	45.8167	25.8000	35TML07	515	TSEC	1					1			0.00	0.00								1997
COVASNA	CV	45.8500	26.1833	35TML37	564	TSEC	3	2	2				1	7	3.50	3.50					3			2000
COVEŞ	SB	45.9833	24.5667	35TLL19	464	HIRT	2	2	2					5	2.50	2.50	2							1998
COZMENI	HR	46.2167	25.9333	35TMM11	676	CIUC	1	1	1					4	4.00	4.00		1						2000
CRĂCIUNEL	HR	46.1833	25.4333	35TLM71	560	HOMO	2	2	2					7	3.50	3.50		2						2000

Table 5. (continued)

Locality	County	Latitude	Longitude	UTM code	Altitude (m)	Region	H	HPa	HPm	HPo	HPx	HE	uH	JZG	JZa	JZm	Electric pylon	Pylon with	Chimney	Roof	Barn	Tree	Other	Census year
CRIHALMA	BV	45.9167	25.2000	35TLL68	437	FAGA	2	2	2					5	2.50	2.50	1					1		2000
CRISTIAN	BV	45.6167	25.4667	35TLL85	624	BIRS	2	2	2					5	2.50	2.50			1				1	1996
CRISTIAN	SB	45.7833	24.0333	35TKL67	441	SIBI	30	30	26	4				78	2.60	3.00	14		15					2000
CRIZBAV	BV	45.8167	25.4667	35TLL87	567	BIRS	3	3	3					7	2.33	2.33			2		1			1996
CUCIULATA	BV	45.9333	25.2667	35TLL68	558	FAGA	3	3	3					10	3.33	3.33	1		2					1996
DACIA	BV	46.0167	25.1500	35TLL59	461	HOMO	1	1	1					2	2.00	2.00							1	2000
DAIA	SB	45.8000	24.2833	35TKL87	425	HIRT	1	1	1					5	5.00	5.00								2000
DĂIŞOARA	BV	45.9667	25.1500	35TLL59	542	FAGA	1	1	1					4	4.00	4.00	1							2000
DALNIC	CV	45.9167	25.9833	35TML28	574	TSEC	1	1	1					3	3.00	3.00			1					1997
DĂNEŞTI	HR	46.5167	25.7500	35TMM05	709	CIUC	3	2	1	1			1	3	1.50	3.00	2				1			2000
DEALU FRUMOS	SB	45.9833	24.7000	35TLL29	526	HIRT	7	7	7					26	3.71	3.71			2	3			1	2000
DEJANI	BV	45.7167	24.9333	35TLL36	570	FAGA	1	1	1					2	2.00	2.00			1					1996
DELNIŢA	HR	46.4167	25.8333	35TMM14	721	CIUC	1	1		1					0.00	0.00	1							2000
DOBOLII DE JOS	CV	45.7833	25.7500	35TML07	526	TSEC	1	1	1					4	4.00	4.00			1					1999
DOBOLII DE SUS	CV	45.7833	26.0333	35TML27	581	TSEC	1	1		1					0.00	0.00					1			1997
DOBOŞENI	CV	46.1167	25.5833	35TLM90	509	BIRS	2	2	2					4	2.00	2.00			1	1				2000
DOPCA	BV	45.9833	25.3833	35TLL79	527	FAGA	1	1	1					4	4.00	4.00	1							2000
DRĂGUŞ	BV	45.7500	24.7833	35TLL26	519	FAGA	1	1		1					0.00	0.00					1			1999
DRĂUŞENI	BV	46.1333	25.3000	35TLM61	442	HOMO	2	2	2					9	4.50	4.50			1	1				2000
DRIDIF	BV	45.8167	24.8833	35TLL37	430	FAGA	1	1	1					5	5.00	5.00	1							2000
DUMBRĂVIŢA	BV	45.7667	25.4333	35TLL76	520	BIRS	3	3	3					7	2.33	2.33			2			1		1996
ESTELNIC	CV	46.1000	26.2166	35TMM30	614	TSEC	1	1			1				0.00	0.00	1							2000
FĂGĂRAŞ	BV	45.8500	24.9667	35TLL47	416	FAGA	1	1	1					2	2.00	2.00			1					1998
FÂNTÂNA	BV	45.9667	25.2833	35TLL69	469	FAGA	1	1	1					2	2.00	2.00	1							2000
FELDIOARA	BV	45.8167	25.6000	35TLL97	494	BIRS	1	1	1					2	2.00	2.00					1			1996
FELMERU	BV	45.9333	25.0167	35TLL48	588	FAGA	1	1	1					3	3.00	3.00	1							2000
FILIA	CV	46.1500	25.6167	35TLM91	522	BIRS	2	2	1	1				2	1.00	2.00			2					2000
GALAŢI	BV	45.8500	24.9667	35TLL47	416	FAGA	1	1	1					2	2.00	2.00			1					1996

Table 5. (continued)

Locality	County	Latitude	Longitude	UTM code	Altitude (m)	Region	H	HPa	HPm	HPo	HPx	HE	uH	JZG	JZa	JZm	Electric pylon	Pylon with	Chimney	Roof	Barn	Tree	Other	Census year
GHELINȚA	CV	45.9500	26.2333	35TML48	614	TSEC	1	1	1					3	3.00	3.00	1							1997
GHIDFALĂU	CV	45.9000	25.8500	35TML18	547	TSEC	1	1	1					4	4.00	4.00	1							1999
GHIMBAV	BV	45.6667	25.5000	35TLL85	562	BIRS	3	3	3					7	2.33	2.33	1		1				1	1996
GRÂNARI	BV	46.0333	24.9667	35TLL49	514	HOMO	4	4	4					12	3.00	3.00	2		2					1996
GURA RÂULUI	SB	45.7333	23.9833	34TGR36	545	SIBI	1	1	1					3	3.00	3.00								2000
GURA VĂII	BV	45.7167	24.9000	35TLL36	579	FAGA	2	2	1	1				2	1.00	2.00	1					1		1999
HĂGHIG	CV	45.8333	25.5833	35TLL87	506	BIRS	7	5	5			1	1	17	3.40	3.40	1				6			2000
HĂLCHIU	BV	45.7667	25.5500	35TLL86	511	BIRS	1	1	1					2	2.00	2.00			1					1996
HĂLMEAG	BV	45.8667	25.1167	35TLL58	438	FAGA	1	1	1					5	5.00	5.00	1							2000
HAMBA	SB	45.8667	24.2000	35TKL88	532	SIBI	1	1	1					2	2.00	2.00				1				2000
HĂRMAN	BV	45.7167	25.6833	35TLL96	525	BIRS	1	1	1					4	4.00	4.00			1					2000
HĂRSENI	BV	45.7500	25.0167	35TLL46	539	FAGA	1	1	1					4	4.00	4.00	1							1999
HĂTUICA	CV	45.9333	26.1333	35TML38	552	TSEC	1	1	1					4	4.00	4.00					1			2000
HERCULIAN	CV	46.1333	25.7000	35TLM90	581	BIRS	1	1	1					4	4.00	4.00			1					2000
HILIB	CV	45.9667	26.2333	35TML49	768	TSEC	1	1		1					0.00	0.00					1			1997
HOGHIZ	BV	45.9833	25.3000	35TLL69	490	FAGA	7	7	6	1				21	3.00	3.50	1		1		5			2000
HOMOROD	BV	46.0500	25.2667	35TLM60	431	HOMO	2	2	2					8	4.00	4.00			2					2000
HUREZ	BV	45.8000	24.9500	35TLL47	454	FAGA	1	1	1					2	2.00	2.00			1					1996
IACOBENI	HR	46.2000	26.1000	35TMM31	736	CASI	1	1	1					4	4.00	4.00	1							1997
IACOBENI	SB	46.0500	24.7167	35TLM20	467	HIRT	1	1	1					4	4.00	4.00								2000
IAȘI	BV	45.7667	24.9333	35TLL37	493	FAGA	1	1	1					1	1.00	1.00					1			1996
IGHIȘU VECHI	SB	45.9833	24.4833	35TLL09	497	HIRT	1	1		1					0.00	0.00	1							2000
ILIENI	CV	45.8000	25.7667	35TML07	538	TSEC	2	2	1	1				3	1.50	3.00	1				1			1999
IMENI	CV	45.9500	26.1667	35TML38	553	TSEC	2	2	1	1				2	1.00	2.00	1				1			1997
INEU	HR	46.5500	25.7667	35TMM05	709	CIUC	1	1	1					3	3.00	3.00	1							2000
IONEȘTI	BV	46.1500	25.3333	35TLM71	517	HOMO	1	1		1					0.00	0.00					1			2000
JIBERT	BV	46.0000	25.0667	35TLL59	503	HOMO	1	1	1					3	3.00	3.00								2000
JIGODIN	HR	46.3333	25.8167	35TMM03	680	CIUC	1	1	1					5	5.00	5.00					1			2000

Table 5. (continued)

Locality	County	Latitude	Longitude	UTM code	Altitude (m)	Region	H	HPa	HPm	HPo	HPx	HE	uH	JZG	JZa	JZm	Electric pylon	Pylon with	Chimney	Roof	Barn	Tree	Other	Census year
JIMBOR	BV	46.1000	25.3833	35TLM70	557	HOMO	1	1	1					4	4.00	4.00			1					2000
LELICENI	HR	46.3500	25.8500	35TMM13	720	CIUC	1	1	1					3	3.00	3.00					1			2000
LEMNIA	CV	46.0500	26.2667	35TML49	590	TSEC	25	21	14	6	1	1	3	45	2.14	3.21	8	10			7			2000
LEŢ	CV	45.8500	26.0167	35TML27	528	TSEC	1	1	1					4	4.00	4.00				1				1997
LISA	BV	45.7167	24.8500	35TLL36	555	FAGA	1	1			1				0.00	0.00	1							1999
LISNĂU	CV	45.7833	25.8833	35TML17	576	TSEC	1	1	1					2	2.00	2.00					1			1997
LOVNIC	BV	45.9833	25.0167	35TLL49	634	HOMO	2	2	2					5	2.50	2.50								2000
LUDIŞOR	BV	45.7667	24.8833	35TLL37	491	FAGA	1	1	1					4	4.00	4.00	1							2000
LUETA	HR	46.2667	25.4833	35TLM82	634	HOMO	1	1		1					0.00	0.00	1							2000
LUNCA CĂLNICULUI	BV	45.7667	25.7667	35TML06	500	BIRS	3	2	2				1	6	3.00	3.00	3							2000
LUNCA OZUNULUI	CV	45.8000	25.8500	35TML17	509	TSEC	1					1			0.00	0.00	1							1997
LUNGA	CV	46.0333	26.2167	35TML39	565	TSEC	3	3	3					10	3.33	3.33	1				2			2000
LUŢA	BV	45.8000	24.9000	35TLL37	451	FAGA	1	1	1					4	4.00	4.00	1							2000
LUTOASA	CV	46.0833	26.2333	35TMM40	596	TSEC	1	1	1					3	3.00	3.00	1							2000
MĂDĂRAŞ	HR	46.5000	25.7500	35TMM05	710	CIUC	3	3	2	1				7	2.33	3.50	2				1			2000
MĂGHERUŞ	CV	45.7833	25.9167	35TML17	574	TSEC	1	1	1					4	4.00	4.00						1		2000
MĂIERUŞ	BV	45.9000	25.5333	35TLL88	477	BIRS	1	1	1					4	4.00	4.00	1							2000
MĂLINIŞ	BV	45.7500	25.0167	35TLL46	539	FAGA	2	2	2					5	2.50	2.50			2					1996
MALNAŞ	CV	46.0167	25.8333	35TML09	572	TSEC	1	1	1					3	3.00	3.00					1			2000
MÂNDRA	BV	45.8167	25.0500	35TLL47	466	FAGA	2	2	1		1			3	1.50	3.00	1		1					2000
MĂRCUŞA	CV	45.9167	26.0500	35TML28	554	TSEC	1	1		1					0.00	0.00	1							1997
MĂRGINENI	BV	45.7167	25.0500	35TLL46	612	FAGA	2	1	1				1	4	4.00	4.00	1					1		1999
MARPOD	SB	45.8667	24.5000	35TLL08	502	HIRT	2	2	2					7	3.50	3.50	2							2000
MĂRTĂNUŞ	CV	46.0167	26.2833	35TML49	605	TSEC	1	1	1					5	5.00	5.00	1							2000
MĂRTINENI	CV	45.9166	26.1000	35TML38	541	TSEC	2	2			2				0.00	0.00	1		1					2000
MĂRTINIŞ	HR	46.2333	25.3833	35TLM72	480	HOMO	1	1	1					4	4.00	4.00		1						2000
MATEIAŞ	BV	46.0167	25.3667	35TLL79	452	FAGA	3	3	3					10	3.33	3.33	2		1					2000

Table 5. (continued)

Locality	County	Latitude	Longitude	UTM code	Altitude (m)	Region	H	HPa	HPm	HPo	HPx	HE	uH	JZG	JZa	JZm	Electric pylon	Pylon with	Chimney	Roof	Barn	Tree	Other	Census year
MERCHEAŞA	BV	46.0667	25.3333	35TLM70	459	HOMO	2	2			2			3	1.50	0.00								2000
MEREŞTI	HR	46.2333	25.4500	35TLM82	592	HOMO	1	1	1					4	4.00	4.00	1							2000
MERGHINDEAL	SB	45.9667	24.7333	35TLL29	481	HIRT	1	1	1					4	4.00	4.00				1				2000
MICFALĂU	CV	46.0500	25.8333	35TMM00	610	TSEC	1	1	1					2	2.00	2.00			1					2000
MICLOŞOARA	CV	46.0167	25.5667	35TLL89	480	BIRS	3	3	3					12	4.00	4.00		1	1		1			2000
MIERCUREA CIUC	HR	46.3500	25.8000	35TMM03	664	CIUC	2	2	1	1				4	2.00	4.00		1			1			2000
MOACŞA	CV	45.8667	25.9667	35TML17	553	TSEC	2	2	2					5	2.50	2.50	2							1997
MOECIU	BV	45.4833	25.3333	35TLL63	978	BIRS	1	1	1					2	2.00	2.00	1							1996
MOHU	SB	45.7333	24.2333	35TKL86	463	SIBI	1	1	1					4	4.00	4.00								2000
MOVILE	SB	46.0167	24.7833	35TLL29	525	HIRT	1	1	1					3	3.00	3.00				1				1998
NĂDEJDEA	HR	46.4833	25.8333	35TMM14	770	CIUC	1	1	1					3	3.00	3.00						1		2000
NETUŞ	SB	46.0500	24.7833	35TLM20	486	HIRT	1	1	1					3	3.00	3.00			1					2000
NOCRICH	SB	45.9000	24.4500	35TLL08	433	HIRT	6	6	6					22	3.67	3.67								2000
NOUL	SB	45.8333	24.2833	35TKL87	456	HIRT	1	1	1					3	3.00	3.00			1					2000
NUCET	SB	45.8000	24.3833	35TKL97	442	HIRT	1	1	1					2	2.00	2.00								1996
OCLAND	HR	46.1667	25.4167	35TLM71	497	HOMO	1						1		0.00	0.00		1						2000
OHABA	BV	45.7667	25.1500	35TLL56	470	FAGA	1	1			1				0.00	0.00	1							1999
OLTENI	CV	45.9667	25.8500	35TML19	562	TSEC	1	1	1					4	4.00	4.00		1						2000
OLTEŢ	BV	45.8000	24.7667	35TLL27	428	FAGA	3	3	3					10	3.33	3.33	3							2000
ORĂŞENI	HR	46.1667	25.3500	35TLM71	466	HOMO	2	2	1	1				5	2.50	5.00		1		1				2000
ORLAT	SB	45.7500	23.9667	34TGR37	512	SIBI	11	11	10	1				31	2.82	3.10	1		4	1				2000
ORMENIŞ	BV	46.0167	25.5500	35TLL89	459	BIRS	1	1		1					0.00	0.00			1					1999
OZUN	CV	45.8000	25.8500	35TML17	515	TSEC	9	9	9					27	3.00	3.00	3		1	1	4			2000
PACHIA	CV	45.8167	26.1167	35TML37	540	TSEC	22	20	17	2	1	1	1	57	2.85	3.35	7				14	1		2000
PALTIN	BV	45.7000	25.2333	35TLL66	526	FAGA	1	1	1					3	3.00	3.00					1			1996
PĂPĂUŢI	CV	45.7833	26.1333	35TML37	562	TSEC	1	1		1					0.00	0.00	1							1999
PĂRĂU	BV	45.8500	25.1833	35TLL57	448	FAGA	3	3	3					7	2.33	2.33	1		1		1			1998
PĂULENI CIUC	HR	46.4000	25.8333	35TMM13	738	CIUC	1	1	1					2	2.00	2.00						1		1997

Table 5. (continued)

Locality	County	Latitude	Longitude	UTM code	Altitude (m)	Region	H	HPa	HPm	HPo	HPx	HE	uH	JZG	JZa	JZm	Electric pylon	Pylon with	Chimney	Roof	Barn	Tree	Other	Census year
PAVA	CV	45.8833	26.1833	35TML38	606	TSEC	1	1	1					4	4.00	4.00	1							2000
PELIŞOR	SB	46.0500	24.5167	35TLM00	541	HIRT	1	1	1					4	4.00	4.00	1							2000
PERŞANI	BV	45.7833	25.2167	35TLL67	559	FAGA	2	2	2					5	2.50	2.50			1	1				1996
PETENI	CV	45.9167	26.1333	35TML38	561	TSEC	2	2	2					5	2.50	2.50	2							1997
PETRENI	HR	45.7167	25.6833	35TLM71	525	HOMO	1	1	1					4	4.00	4.00					1			2000
PLĂIEŞII DE SUS	HR	46.2333	26.1000	35TMM32	725	CASI	1	1	1					2	2.00	2.00			1					1997
PODU OLTULUI	BV	45.7167	25.6833	35TLL96	525	BIRS	1	1			1				0.00	0.00			1					1999
POIAN	CV	46.0667	26.1500	35TMM30	593	TSEC	1	1		1					0.00	0.00	1							1997
POJORTA	BV	45.7500	24.8667	35TLL36	516	FAGA	2	2	2					5	2.50	2.50			1		1			1996
POPLACA	SB	45.7167	24.0500	35TKL76	516	SIBI	1	1	1					3	3.00	3.00								2000
PORUMBACUL DE JOS	SB	45.7500	24.4500	35TLL06	404	FAGA	2	2	1	1				2	1.00	2.00			2					2000
PREJMER	BV	45.7167	25.7667	35TML06	524	BIRS	18	14	14			2	2	44	3.14	3.14	2		10	5		1		2000
RACOŞUL DE JOS	BV	46.0333	25.4000	35TLL79	475	FAGA	1	1	1					4	4.00	4.00			1					2000
RACOŞUL DE SUS	CV	46.0833	25.5333	35TLM80	479	BIRS	2	2	2					6	3.00	3.00		1	1					2000
RACOVIŢA	SB	45.6833	24.3500	35TKL96	414	FAGA	6	6	5	1				16	2.67	3.20	3		1		1			2000
RACU	HR	46.4500	25.7500	35TMM04	712	CIUC	1	1	1					2	2.00	2.00	1							2000
RAREŞ	HR	46.2000	25.3833	35TLM71	491	HOMO	1	1	1					3	3.00	3.00							1	2000
RĂŞINARI	SB	45.7000	24.0667	35TKL76	677	SIBI	1	1	1					3	3.00	3.00			1					2000
RÂŞNOV	BV	45.5833	25.4500	35TLL74	684	BIRS	2	2	2					5	2.50	2.50				1	1			1996
RECEA	BV	45.7167	24.9333	35TLL36	570	FAGA	2	2	1	1				4	2.00	4.00	2							1999
RECI	CV	45.8500	25.9333	35TML17	548	TSEC	1	1	1					2	2.00	2.00	1							2000
RETIŞU	SB	46.0500	24.8500	35TLM30	465	HIRT	1	1	1					3	3.00	3.00								1999
RODBAV	BV	45.9167	24.8667	35TLL38	474	FAGA	1	1	1					3	3.00	3.00			1					2000
ROŞIA SĂSEASCĂ	SB	45.8167	24.3167	35TKL97	422	HIRT	1	1	1					4	4.00	4.00								2000
ROTBAV	BV	45.8333	25.5500	35TLL87	509	BIRS	2	2	2					7	3.50	3.50			2					2000
RUCĂR	BV	45.8167	24.7667	35TLL27	402	FAGA	1	1	1					3	3.00	3.00				1				2000
RUPEA	BV	46.0333	25.2167	35TLL69	471	HOMO	1	1	1					3	3.00	3.00								2000
RUŞCIORI	SB	45.8167	24.0333	35TKL67	440	SIBI	1	1	1					1	1.00	1.00								1996

Table 5. (continued)

Locality	County	Latitude	Longitude	UTM code	Altitude (m)	Region	H	HPa	HPm	HPo	HPx	HE	uH	JZG	JZa	JZm	Electric pylon	Pylon with	Chimney	Roof	Barn	Tree	Other	Census year
SĂCĂDATE	SB	45.7667	24.3833	35TKL97	394	FAGA	1	1	1					4	4.00	4.00								2000
SĂCEL	SB	45.7833	23.9333	34TGR27	516	SIBI	2	2	2					8	4.00	4.00	1		1					2000
SĂCELE	BV	45.6167	25.6833	35TLL95	687	BIRS	2	2	2					5	2.50	2.50			2					2000
SACIOVA	CV	45.7833	25.9500	35TML17	649	TSEC	1	1	1					3	3.00	3.00	1							1997
SADUL	SB	45.6667	24.1833	35TKL86	637	SIBI	1	1	1					3	3.00	3.00								2000
SĂLIŞTE	SB	45.7833	23.8833	34TGR27	607	SIBI	2	2	2					4	2.00	2.00	2							2000
SÂMBĂTA DE JOS	BV	45.8000	24.8167	35TLL37	426	FAGA	2	2	2					3	1.50	1.50			1		1			1996
SÂMBĂTA DE SUS	BV	45.7500	24.8167	35TLL36	512	FAGA	7	7	7					25	3.57	3.57	3				4			2000
SÂNCRĂIENI	HR	46.3000	25.8500	35TMM12	659	CIUC	4	3	1	2			1	5	1.67	5.00		2			2			2000
SÂNDOMINIC	HR	46.5833	25.7833	35TMM05	757	CIUC	1	1	1					5	5.00	5.00			1					2000
SÂNMARTIN	HR	46.2667	25.9333	35TMM12	676	CIUC	1	1	1					4	4.00	4.00		1						2000
SÂNPAUL	HR	46.1833	25.3833	35TLM71	472	HOMO	18	18	15	3				48	2.67	3.20	5	11	1	1				2000
SÂNPETRU	BV	45.7167	25.6333	35TLL96	535	BIRS	3	2	2				1	4	2.00	2.00			2	1				1996
SÂNSIMION	HR	46.2500	25.8833	35TMM12	646	CIUC	27	27	24	3				81	3.00	3.38	2	17			8			2000
SÂNTIMBRU	HR	46.2833	25.8667	35TMM12	652	CIUC	8	6	6				2	22	3.67	3.67	3	2			3			2000
SÂNTION LUNCA	CV	45.8167	25.8667	35TML17	525	TSEC	5	5	5					15	3.00	3.00		2		1	2			2000
SÂNZIENI	CV	46.0500	26.1333	35TML39	593	TSEC	1	1	1					3	3.00	3.00			1					1997
SĂRATA	SB	45.7333	24.5000	35TLL06	442	FAGA	1	1	1					2	2.00	2.00								1996
SĂSĂUŞI	SB	45.8500	24.6000	35TLL18	567	FAGA	1	1			1				0.00	0.00						1		2000
SATU NOU	BV	45.7667	25.5167	35TLL86	517	BIRS	3	3	3					12	4.00	4.00			3					2000
SATU NOU	HR	46.1500	25.4000	35TLM71	507	HOMO	1	1	1					3	3.00	3.00		1						2000
SCOREI	SB	45.7500	24.5333	35TLL06	450	FAGA	12	11	8	3			1	26	2.36	3.25	6				5			2000
SEBEŞUL DE JOS	SB	45.6500	24.3333	35TKL95	507	SIBI	1	1	1					2	2.00	2.00	1							2000
SEBEŞUL DE SUS	SB	45.6500	24.3500	35TKL95	489	FAGA	1	1	1					4	4.00	4.00	1							2000
ŞELIMBĂR	SB	45.7667	24.2000	35TKL87	379	SIBI	1	1	1					4	4.00	4.00			1					2000
ŞELISTA	BV	45.9833	24.8500	35TLL39	567	HIRT	2	2	2					7	3.50	3.50	1		1					2000
ŞERCAIA	BV	45.8500	25.1333	35TLL57	444	FAGA	6	5	5				1	18	3.60	3.60	3		3					2000
ŞERCĂIŢA	BV	45.7333	25.1167	35TLL56	538	FAGA	1	1		1					0.00	0.00	1							1999

Table 5. (continued)

Locality	County	Latitude	Longitude	UTM code	Altitude (m)	Region	H	HPa	HPm	HPo	HPx	HE	uH	JZG	JZa	JZm	Electric pylon	Pylon with	Chimney	Roof	Barn	Tree	Other	Census year
SFÂNTU GHEORGHE	CV	45.8667	25.7833	35TML07	510	TSEC	1	1		1					0.00	0.00			1					1998
SIBIU	SB	45.8000	24.1500	35TKL77	401	SIBI	6	6	6					17	2.83	2.83								2000
SICULENI	HR	46.4167	25.7500	35TMM04	677	CIUC	11	8	7	1		1	2	23	2.88	3.29	2	5			3	1		2000
ŞINCA VECHE	BV	45.7667	25.1667	35TLL56	479	FAGA	1	1	1					4	4.00	4.00			1					2000
ŞOARŞ	BV	45.9333	24.9167	35TLL38	488	FAGA	2	2	2					8	4.00	4.00	1		1					2000
ŞONA	BV	45.8500	25.0500	35TLL47	430	FAGA	1	1	1					2	2.00	2.00	1							2000
STUPINI	BV	45.7000	25.5667	35TLL86	527	BIRS	2	2	2					5	2.50	2.50			1	1				1996
ŞUMULEU-CIUC	HR	46.3833	25.8333	35TMM13	814	CIUC	1						1		0.00	0.00			1					2000
ŞURA MARE	SB	45.8500	24.1667	35TKL88	461	SIBI	1	1	1					3	3.00	3.00			1					2000
ŞURA MICĂ	SB	45.8667	24.0667	35TKL78	402	SIBI	2	2	2					8	4.00	4.00								2000
SURCEA	CV	45.8833	26.0833	35TML28	536	TSEC	2	2	1	1				4	2.00	4.00	1				1			2000
SZASZFALU (LUNGA)	CV	46.0167	26.2000	35TML39	562	TSEC	1	1	1					3	3.00	3.00	1							2000
TĂLIŞOARA	CV	46.1000	25.5833	35TLM90	494	BIRS	3	2	1	1			1	4	2.00	4.00			3					2000
TĂLMACIU	SB	45.6500	24.2667	35TKL85	418	SIBI	2	2	1	1				5	2.50	5.00	1		1					2000
TAMAŞFALĂU	CV	45.8833	26.1167	35TML38	541	TSEC	2	2	2					5	2.50	2.50	2							2000
TÂRGU SECUIESC	CV	46.0000	26.1333	35TML39	570	TSEC	1	1	1					2	2.00	2.00			1					2000
TELECHIA	CV	45.8666	26.0333	35TML27	534	TSEC	1	1	1					4	4.00	4.00	1							2000
TELIU	BV	45.7000	25.8500	35TML16	622	BIRS	1	1	1					2	2.00	2.00				1				1996
TICUŞUL VECHI	BV	45.9333	25.1000	35TLL58	485	FAGA	2	2	1	1				2	1.00	2.00								1999
TINOASA	CV	46.0000	26.1833	35TML39	560	TSEC	6	6	5	1				15	2.50	3.00	4				1	1		2000
TOARCLA	BV	45.9000	24.7333	35TLL28	461	FAGA	1	1	1					4	4.00	4.00	1							2000
TODERIŢA	BV	45.7833	25.0667	35TLL47	495	FAGA	4	4	4					10	2.50	2.50			1		3			1996
TOHANU NOU	BV	45.5500	25.3833	35TLL74	719	BIRS	1	1	1					2	2.00	2.00			1					1996
TOHANU VECHI	BV	45.5667	25.3667	35TLL74	705	FAGA	1	1	1					3	3.00	3.00	1							1996
TOPLIŢA-CIUC	HR	46.3666	25.8000	35TMM03	673	CIUC	2	1	1				1	3	3.00	3.00	2							2000
ŢUFALĂU	CV	45.8333	26.0167	35TML27	528	TSEC	3	3	2		1			6	2.00	3.00	1	2						2000
TURIA	CV	46.0167	26.1500	35TML39	616	TSEC	2	2	2					9	4.50	4.50		2						2000
TURNU ROŞU	SB	45.6333	24.3000	35TKL85	618	FAGA	1	1	1					2	2.00	2.00						1		2000

Table 5. (continued)

Locality	County	Latitude	Longitude	UTM code	Altitude (m)	Region	H	HPa	HPm	HPo	HPx	HE	uH	JZG	JZa	JZm	Electric pylon	Pylon with	Chimney	Roof	Barn	Tree	Other	Census year
TUŞNAD	HR	46.2167	25.9000	35TMM11	672	CIUC	6	6	6					22	3.67	3.67	1				5			2000
TUŞNADU NOU	HR	46.2000	25.8833	35TMM11	655	CIUC	5	4	2	1	1		1	6	1.50	3.00	1	3	1					2000
UCEA DE JOS	BV	45.7833	24.6667	35TLL17	425	FAGA	1						1		0.00	0.00	1							2000
UCEA DE SUS	BV	45.7500	24.6833	35TLL16	510	FAGA	2	1	1				1	4	4.00	4.00	1				1			2000
UNGRA	BV	45.9833	25.2667	35TLL69	457	FAGA	6	6	6					18	3.00	3.00	4		2					2000
VAD	BV	45.7833	25.1333	35TLL57	475	FAGA	3	2	2				1	6	3.00	3.00	1				2			2000
VALEA CRIŞULUI	CV	45.9167	25.7833	35TML08	606	TSEC	1	1	1					3	3.00	3.00			1					1999
VALEA SEACĂ	CV	46.0833	26.1166	35TMM30	622	TSEC	2	2		1	1				0.00	0.00	1	1						2000
VÂRD	SB	45.9500	24.6000	35TLL19	489	HIRT	1	1	1					4	4.00	4.00			1					2000
VÂRGHIŞ	CV	46.1333	25.5333	35TLM80	498	BIRS	2	2	2					7	3.50	3.50	1		1					2000
VENEŢIA	BV	45.8667	25.2000	35TLL68	466	FAGA	12	11	10	1			1	33	3.00	3.30	4		2		6			2000
VEŞTEM	SB	45.7167	24.2333	35TKL86	366	SIBI	1	1	1					4	4.00	4.00			1					2000
VICTORIA	BV	45.7333	24.6833	35TLL16	541	FAGA	1	1	1					2	2.00	2.00			1					1996
VISCRI	BV	46.0500	25.0833	35TLM50	577	HOMO	1	1	1					1	1.00	1.00								2000
VIŞTEA DE JOS	BV	45.7833	24.7333	35TLL27	443	FAGA	4	4	4					8	2.00	2.00	2		2					1996
VIŞTEA DE SUS	BV	45.7333	24.7500	35TLL26	544	FAGA	1	1			1				0.00	0.00	1							1999
VLĂDENI	BV	45.7667	25.3667	35TLL76	573	BIRS	1	1	1					3	3.00	3.00			1					1996
VLĂHIŢA NOUĂ	HR	46.3500	25.5167	35TLM83	827	HOMO	1	1	1					3	3.00	3.00	1							2000
VOILA	BV	45.8167	24.8500	35TLL37	420	FAGA	3	3	3					9	3.00	3.00	1		1		1			1996
VOIVODENII MARI	BV	45.7833	24.8667	35TLL37	466	FAGA	1	1	1					3	3.00	3.00			1					2000
VRABIA	HR	46.2167	25.9167	35TMM11	655	CIUC	1	1		1					0.00	0.00					1			2000
VULCAN	BV	45.6333	25.4167	35TLL75	599	BIRS	3	3	3					6	2.00	2.00	1		1			1		2000
VURPĂR	SB	45.8000	24.3500	35TKL97	531	HIRT	1	1	1					5	5.00	5.00	1							2000
ZĂBALA	CV	45.9000	26.1833	35TML38	571	TSEC	1	1	1					4	4.00	4.00	1							2000
ZĂLAN	CV	45.9500	25.8167	35TML08	638	TSEC	1	1		1					0.00	0.00					1			1997
ZĂRNEŞTI	BV	45.5500	25.3000	35TLL64	776	BIRS	4	4	4					8	2.00	2.00			3		1			1996
ZOLTAN	CV	45.9333	25.8500	35TML18	553	TSEC	1	1	1					4	4.00	4.00					1			1999
							772	**721**	**617**	**77**	**27**	**13**	**38**	**1965**	**2.883**	**3.338**	**234**	**86**	**159**	**30**	**173**	**18**	**7**	

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